<u>In the Specification</u>:

Please amend paragraphs [0016], [0028], [0035], [0036], [0040], [0041], [0044], [0045], [0054], [0056], and [0063] as follows:

[0016] Embodiments of the invention generally relate to a method for etching in a processing platform (e.g., a cluster tool) wherein robust pre-etch and post-etch data may be obtained in-situ. The method includes the steps of obtaining pre-etched critical dimension (CD) measurements of a feature on a substrate, etching the feature[[;]], treating the etched substrate to reduce and/or remove sidewall polymers deposited on the feature during etching, and obtaining post-etched CD measurements. The CD measurements may be utilized to adjust the etch process to improved the accuracy and repeatability of device fabrication.

[0028] The TRANSFORMA™ measuring system is available from Applied Materials, Inc. of Santa Clara, California and is disclosed in commonly assigned U.S. patent 6,486,492 [[B1]], issued November 26, 2002, ~~as well as U.S. patent 6,150,664, issued November 21, 2000,~~ which ~~are~~ <u>is</u> incorporated herein by reference. The measurements of the critical dimensions are generally performed in a statistically significant number of regions (e.g., 5 to 9 or more regions) of the substrate, and then averaged for each substrate.

[0035] In one illustrative embodiment, the gate electrode layer 206 comprising polysilicon is etched in the DPS II module by providing hydrogen bromide (HBr) at a flow rate of 20 to 300 sccm, chlorine (Cl_2) at a flow rate of 20 to 300 sccm (i.e., a $HBr:Cl_2$ flow ratio ranging from 1:15 to 15:1), <u>and</u> nitrogen (N_2) at a flow rate of 0 to 200 sccm, applying power to an inductively coupled antenna between 200 and 3000 W, applying a cathode bias power between 0 and 300 W and maintaining a wafer temperature between 20 and 80 degrees Celsius at a pressure in the process chamber between 2 and 100 mTorr. One exemplary process provides HBr at a flow rate of 40 sccm, Cl_2 at a flow rate of 40 sccm (i.e., a $HBr:Cl_2$ flow ratio of about 1:1), N_2 at a flow rate of 20 sccm, applies 1100 W of power to the antenna, 20 W of cathode bias power

and maintains a wafer temperature of 45 degrees Celsius at a chamber pressure of 45 mTorr. Such a process provides etch selectivity for polysilicon (layer 206) over hafnium dioxide (layer 204) of at least 100:1, as well as etch selectivity for polysilicon over photoresist (mask 212) of about 3:1.

[0036] During step 108, a portion of the material removed from the gate electrode layer 206 combines with components of the etchant gas mixture (e.g., halogen-containing gases) as well as components of the mask 212 forming non-volatile compounds. Such non-volatile compounds may become redeposited onto the substrate 200, forming a polymeric residue layer 207 (shown with broken lines in FIG. 2C). The polymeric residue layer 207 is typically formed on sidewalls 205 of the gate electrode 216, the surface 203 of the gate dielectric layer 204, and elsewhere on the substrate 200. The residue layer 207 may typically have a thickness 217 of about 10 to 400 Angstroms, wherein the layer 207 generally has the least thickness on the sidewalls 205. To provide accurate post-etch measurements of a width 215 of the gate electrode 216, the measuring technique should not be carried out unless and until the thickness of the sidewall residue is ~~reduced~~ acceptable as described below. One such measuring technique, for example, is optical scatterometry. If the sidewall depositions (e.g., polymeric residue layer 207) have a thickness of not greater than about 10 nm, the optical scatterometric measuring technique may be performed without post-etch treatment. Therefore, using the TRANSFORMA™ measuring system, the critical dimensions of structures formed during etch step 108 may be accurately measured when a thickness of the polymeric residue on sidewalls thereof is not greater than about 10 nm.

[0040] The strip process may be performed using, e.g., the AXIOM™ module (available from Applied Materials, Inc. of Santa Clara, California) of the CENTURA® system. The AXIOM™ module is a remote plasma reactor in which a radio-frequency (RF) plasma is confined such that only reactive neutrals are allowed to enter a reaction volume of the process chamber. Such a confinement scheme precludes plasma-related damage of the substrate or circuits formed on the substrate. Similar to the DPS II

reactor, the AXIOM™ module may use an endpoint detection system. The AXIOM™ module is described in detail in ~~US~~ U.S. patent application serial number 10/264,664, filed October 4, 2002, which is herein incorporated by reference. The salient features of the reactor are briefly described below with reference to FIG. 4. Alternatively, the strip process may be performed using the DPS II module.

[0041] In one illustrative embodiment, the polymeric residue layer 207 and photoresist mask 212 are compacted/outgassed using the AXIOM™ module by providing nitrogen (N_2) at a flow rate of 300 to 1000 sccm, hydrogen (H_2) at a flow rate of 0 to 100 sccm (i.e., a N_2:H_2 flow ratio ranging from 3:1 to 100% N_2), and oxygen (O_2) at a flow rate of 1000 to 5000 sccm, applying power to an inductively coupled power source between about 1000 to 7000 W at about 200 to 600 kHz to form the remote plasma and maintaining a wafer temperature between 200 and 350 degrees Celsius at a pressure in the process chamber between 500 and 2000 mTorr. One exemplary process provides N_2 at a flow rate of 768 sccm, H_2 at a flow rate of 32 sccm (i.e., a N_2:H_2 flow ratio of about 24:1), and O_2 at a flow rate of 3500 sccm, applies 5000 W of power to the inductive power source to form the remote plasma and maintains a wafer temperature of 250 degrees Celsius at a chamber pressure of 750 mTorr.

[0044] At step 116, the measured dimensions (e.g., critical dimensions) of the etched structures are averaged and the processor of the system controller of the integrated semiconductor wafer processing system or, alternatively, the processor of the controller of the etch reactor, calculates an adjustment for the trimming process recipe to be used at step 106 for trimming the patterned masks 212 of the subsequent substrate (or substrates).

[0045] Calculations of the adjustment to the trimming process recipe may be based on the results of post-etch measurements performed, at step 112, on one of preceding substrates or, alternatively, on averaged results of such measurements performed on a group of the preceding substrates. In one embodiment, such an adjustment comprises modifying a duration of the trimming process or modifying other process parameters for

the trimming process (e.g., a flow rate and/or pressure of an etchant gas or gases, a plasma source power, a substrate bias power, and the like). During processing of one or more subsequent substrates, the adjusted trimming process facilitates forming gate structures having the pre-determined critical dimensions.

[0054] [[A]] The controller 340 comprises a central processing unit (CPU) 344, a memory 342, and support circuits 346 for the CPU 344 and facilitates control of the components of the chamber 310 and, as such, of the etch process, as discussed below in further detail.

[0056] The temperature of the wafer 314 is controlled by stabilizing a temperature of the support pedestal 316. In one embodiment, helium gas from a gas source 348 is provided via a gas conduit 349 to channels (not shown) formed in the pedestal surface under the wafer 314. The helium gas is used to facilitate heat transfer between the pedestal 316 and the wafer 314. During processing, the pedestal 316 may be heated by a resistive heater (not shown) within the pedestal to a ~~steady state~~ steady-state temperature and then the helium gas facilitates uniform heating of the wafer 314. Using such thermal control, the wafer 314 is maintained at a temperature between about 20 to 350 degrees Celsius.

[0063] The vacuum pump 414 is coupled to an exhaust port 436 formed in the sidewall 416 of the process chamber 402. The vacuum pump 414 is used to maintain a desired gas pressure in the process chamber ~~102~~ 402, as well as evacuate the post-processing gases and other volatile compounds from the chamber. In one embodiment, the vacuum pump 414 uses a throttle valve 438 to control a gas pressure in the process chamber 402.